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Cost And Time Performance Analysis With Concept Of Earned Value (Case Study Jakarta-Cikampek II Elevated Project)

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ABSTRACT

The research procedure starts with conducting a literature study, collecting data, and summarizing the results of gathering existing data. The purpose of this study is to evaluate the deviation of costs and time, calculate the estimated cost and time needed to complete the project work, calculate the estimated profit or loss that may occur in the completion of the project. Variants emphasized here are to investigate deviations in costs or planned schedules that have been planned or determined. The results of the analysis in Jakarta-Cikampek II Elevated Project stated that in July 2019 the SPI value was $0.96 < 1$ which could be interpreted that the project progress had been delayed and the CPI value was $1.44 > 1$ which could be interpreted that the actual the project cost is still smaller than the total budget cost. Estimated total costs up to the end of the project in the amount of Rp.2,694,413,965,781 of the total budget cost of Rp. 3,872,143,387,752 can save Rp.1,177,729,421,971. As for the estimated time to finish until the end of the project which is for 918 days from the time of the 915 day contract, there will be a delay of 3 days.

Keywords: Earned Value Analysis, Schedule Performance Index, Cost Performance Index

INTRODUCTION

The Jakarta-Cikampek II elevated Project is one of the largest projects in which it has many elements. The President Director of PT Jasa Marga stated in the interview that the traffic on the Jakarta-Cikampek toll road averaged 150,000 vehicles / day, it is normal if there are three lanes of 35,000 vehicles / day, therefore new toll roads must be built [1]. The project is scheduled for completion on March 27, 2019. But in reality the project has been delayed and has to be extended. In the 28th month there was a progress deviation of 3.66% with a difference in the cost of Rp.141,569,173,010 to the contract after the addendum of extended time. This delay is of course influenced by a number of factors which ultimately have an impact on completion of implementation time and expense.

Control of a project must be carried out from the beginning until the project is completed. This control is one way to keep the work going according to plan and not experience losses both in terms of time and cost. There are several concepts, one of which is earned value analysis. The concept of earned value presents three dimensions, namely the physical completion of the project, the actual costs already incurred, and what is obtained from the costs that have been incurred. Of the three dimensions can be connected between cost and time performance derived from the calculation of cost and time variants [5]. By using this earned value method, can the project complete the work on time and does the cost required to settle the remaining work be added or not. This is also certainly a way to evaluate the project as learning for further projects.

The Purpose of this research is :

1. To know the project performance in terms of cost and time in the Jakarta-Cikampek II Elevated project.
2. To Know the estimated costs and time needed to complete the project.

RESEARCH METHODS

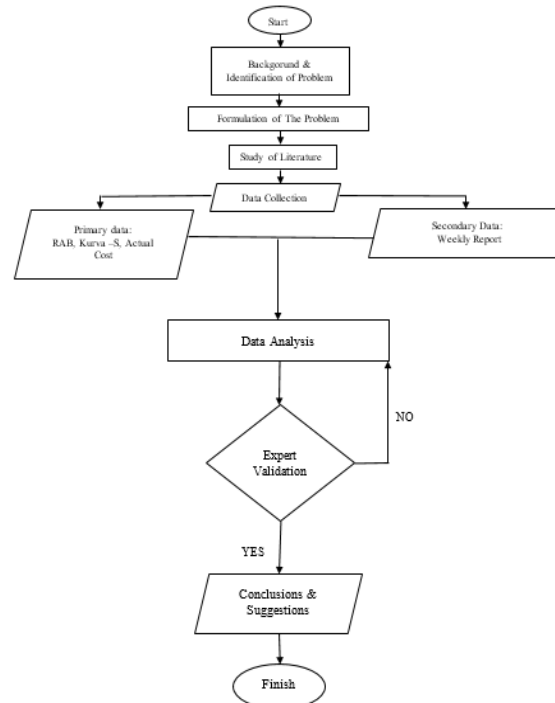


Fig. 1 Flow Chart

Source: Data in research, 2019

To solve that problem, it needs several steps as follows:

1. Start
2. Background and identification of problems
3. Formulation of the problem
4. Study of literature
5. Data Collection:
 - a. Primary data : RAB, Kurva-S, Actual Cost
 - b. Secondary data: Weekly report
6. Data analysis:
 - a. Calculating of BCWS, BCWP, and ACWP
 - b. Calculating of Schedule Varians dan Cost Varians
 - c. Calculating of Cost Performance Index and Schedule Performance Index
 - d. Calculating of Budget Estimate to Complete and Budget Estimate at Completion
 - e. Calculating of Schedule Estimate to Complete and Schedule at Completion
7. Expert Validation : Project Engineering Manager, Planning Manager, Chief Quantity Surveyor
8. Finish

RESULTS AND DISCUSSION

Budgeted Cost of Work Schedule (BCWS)

Budgeted Cost of Work Schedule is a budget that is allocated based on a work plan that has been prepared against time.

-Until July 2019 (28th Month)

$$BCWS = \%Progress\ Plan \times Total\ Budget$$

$$BCWS = 92,20\% \times \text{Rp. } 3,872,143,387,753 = \text{Rp. } 3,570,215,975,282,-$$

Actual Cost Work Performance (ACWP)

Actual costs are real costs that have been incurred by the project for a certain period to be used as direct and indirect costs.

-Until July 2019 (28th Month)

$$ACWP = \text{Rp. } 2,385,808,815,085$$

Budget Cost Work Performance (BCWP)

Budget Cost Work Performance is the value received from completing work over a certain period of time.

-Until July 2019 (28th Month)

$$BCWP = \% \text{Progress Actual} \times \text{Total Budget}$$

$$BCWP = 88,55\% \times \text{Rp. } 3,872,143,387,752 = \text{Rp. } 3,428,646,802,272,-$$

Cost Varians (CV)

Cost Variance is the difference between the value obtained after completing work packages with the actual costs during the project implementation.

-Until July 2019 (28th Month)

$$CV = BCWP - ACWP$$

$$CV = \text{Rp. } 3,428,646,802,272 - \text{Rp. } 2,385,808,815,085 = \text{Rp. } 1,042,837,987,187,-$$

Schedule Varians (SV)

Schedule Variance is the difference between the value obtained after completing work packages with the progress plan

-Until July 2019 (28th Month)

$$SV = BCWP - BCWS$$

$$SV = \text{Rp. } 3,428,646,802,272 - \text{Rp. } 3,570,215,975,282 = \text{Rp. } -141,569,173,010$$

Cost Performance Index (CPI)

Cost efficiency factors that have been incurred in project implementation can be shown by comparing the value of work that has been physically completed (BCWP) with costs that have been incurred in the same period (ACWP).

-Until July 2019 (28th Month)

$$CPI = \frac{BCWP}{ACWP} = \frac{\text{Rp. } 3,428,646,802,272}{\text{Rp. } 2,385,808,815,085} = 1,44$$

Schedule Performance Index (SPI)

The performance efficiency factor in completing work can be shown by the comparison between the value of work that has been physically completed (BCWP) with planned expenditure of expenses based on the work plan (BCWS).

-Until July 2019 (28th Month)

$$SPI = \frac{BCWP}{BCWS} = \frac{\text{Rp. } 3,428,646,808,272}{\text{Rp. } 3,570,215,975,282} = 0,96$$

Budget Estimate to Complete (BETC)

BETC is an estimate of the costs required to complete the remaining work, so BETC is the remaining work budget divided by the cost performance index.

-Until July 2019 (28th Month)

$$BETC = \frac{(BAC - BCWP)}{CPI}$$

$$BETC = \frac{(\text{Rp. } 3,872,143,487,753 - \text{Rp. } 3,428,646,802,272)}{1,44}$$

$$BETC = Rp. 308,605,150,696$$

Budget Estimate at Completion (BEAC)

BEAC is the total expenditure until the time of reporting plus estimated costs for remaining work.

-Until July 2019 (28th Month)

$$BEAC = ACWP + BETC$$

$$BEAC = Rp. 2,385,808,815,085 + Rp. 308,605,150,696$$

$$BEAC = Rp. 2,694,413,965,781$$

Schedule Estimate to Complete (SETC)

SETC is the estimated remaining time needed to complete the work.

-Until July 2019 (28th Month)

$$SETC = \frac{\text{Total Implementation Time} - \text{Time Spent}}{SPI}$$

$$SETC = \frac{(915 - 854)}{0,96} = 64 \text{ days}$$

Schedule Estimate at Completion (SEAC)

SEAC is the amount of time the work was carried out until the time of reporting plus the estimated time needed to complete the remaining work.

-Until July 2019 (28th Month)

$$SEAC = \text{Time Spent} + SETC$$

$$SEAC = 854 + 64 = 918 \text{ days}$$

Table 1. Calculation EVM

Calculation	Until July 2019 (28 th Week)	Note
BCWS	Rp. 3,570,215,975,282	
ACWP	Rp. 2,385,808,815,085	
BCWP	Rp. 3,428,646,802,272	
Cost Varians	Rp. 1,042,837,987,187	(+) Actual Cost are below Budget Cost
Schedule Varians	Rp. -141,569,173,010	(-) The project has been delayed
Cost Performance Index	1,44	CPI > 1 (Cost performance is good)
Schedule Performance Index	0,96	SPI < 1 (time performance is bad)
BETC	Rp. 308,605,150,696	
BEAC	Rp. 2,694,413,965,781	
SETC	64 days	
SEAC	918 days	

Source: Data in research, 2019

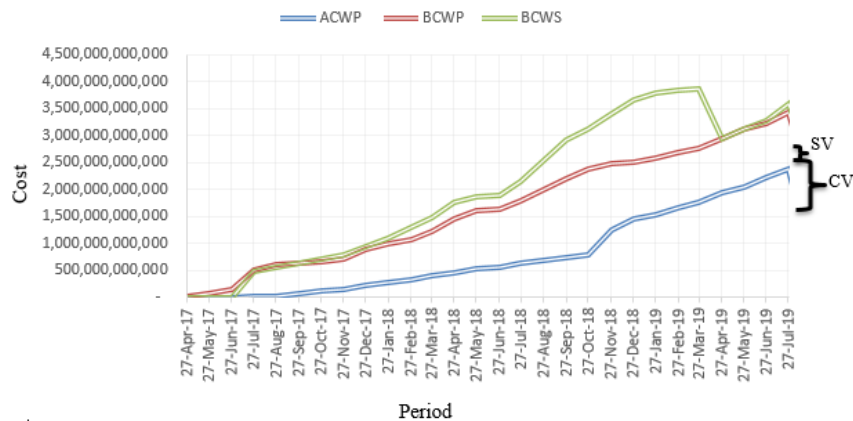


Figure 2. Chart Earned Value
Source: Data in research, 2019

According the Figure 2 above, it can be seen at the end of July (28th month) the value of $BCWS > BCWP$, which can be interpreted that the actual progress is delayed from the progress plan with a difference (SV) of Rp.-141,569,173,010. For the same period it can also be seen that the $ACWP < BCWP$, it can be interpreted the amount of the budget that has been issued is smaller than the total budget cost with a difference (CV) of Rp.1,042,837,987,187

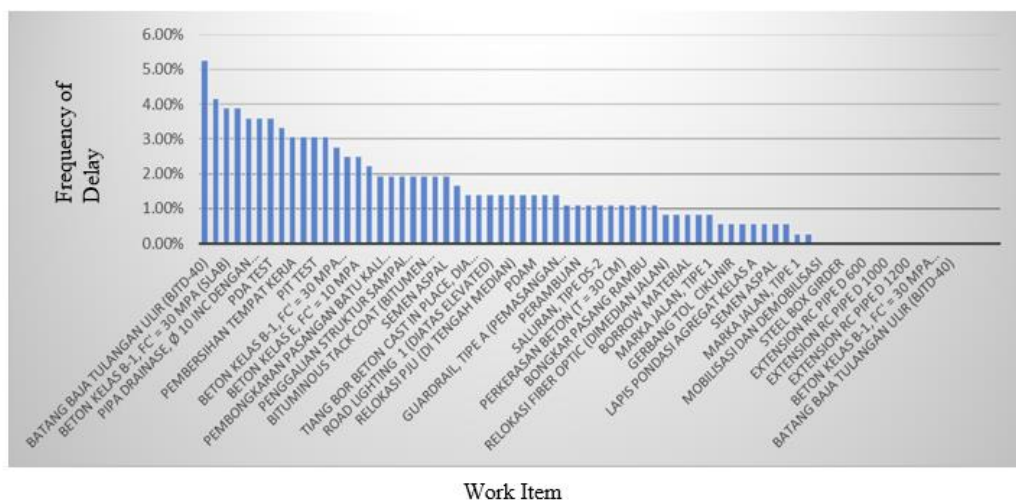


Figure 3. Frequency of Delay
Source: Data in research, 2019

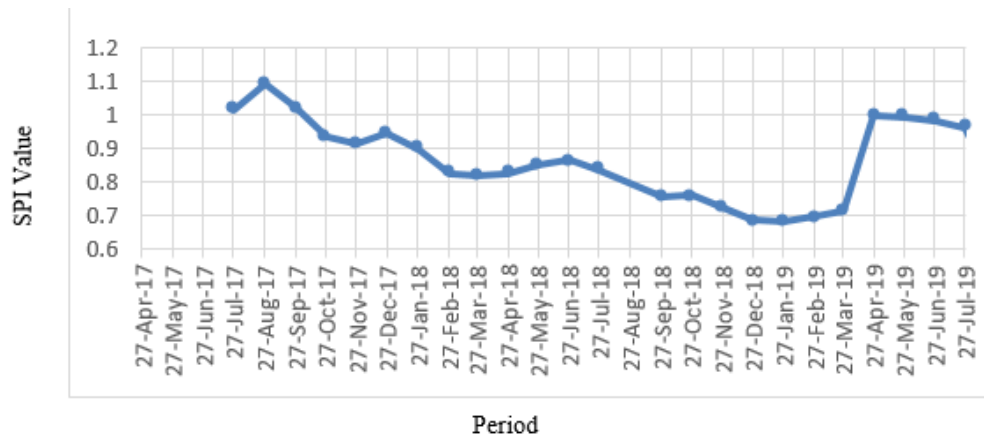


Figure 4: SPI Value

Source: Data in research, 2019

According to Figure-3 it can be seen that the frequency of work that experiences the most delays is reinforcing, slab concrete work and drainage pipe work. Because of delays in the work it will affect the next job. And in Figure-4 the smallest SPI value is found in January 2019 which is equal to 0.68. This month there was a delay in the work of Slabs, drainage, double barriers, signs and PJU.

CONCLUSION

1. In July (28th month) the cumulative value of $BCWS > BCWP$ with SV minus (-) in the amount of Rp.-141,569,173,010 and SPI value of $0,96 < 1$ which means that the project progress has been delayed. For the same period it can also be seen that the cumulative value of $ACWP < BCWP$ with a CV plus (+) value of Rp.1,042,837,987,187 and a CPI value of $1,44 > 1$ which can be interpreted that the actual cost of the project is still smaller than the total cost of the Budget.

2. Estimated total costs up to the end of the project (BEAC) in the amount of Rp.2,694,413,965,781 of the total budget cost of Rp.3,872,143,387,752 then can save Rp.1,177,729,421,971.-. As for the estimated time to finish until the end of the project (SEAC) which is for 918 days from the time of the 915 day contract, there will be a delay of 3 days.

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